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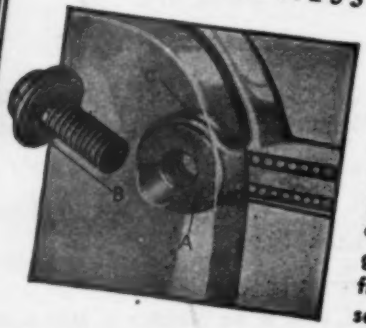

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Vol. 21 — No. 3

CONTENTS

ORIGINAL PAPERS

Page

The Nervous Control of Accommodation. Merdith W. Morgan 87

A Standard Needed for U. S. Army Ocular Refractions. John D. Locke 94

Evolution of Color Vision Tests. Part I. Elsie Murray 97

EDITORIALS

Inimical Discrimination Against the Male Nurse and the Optometrist. Carel C. Koch 110

TRANSACTIONS OF THE ACADEMY by J. Fred Andreae 113

ANNOUNCEMENTS 115

SPECIAL REPORTS 116

BOOK NOTICES 121

ABSTRACTS 125-128

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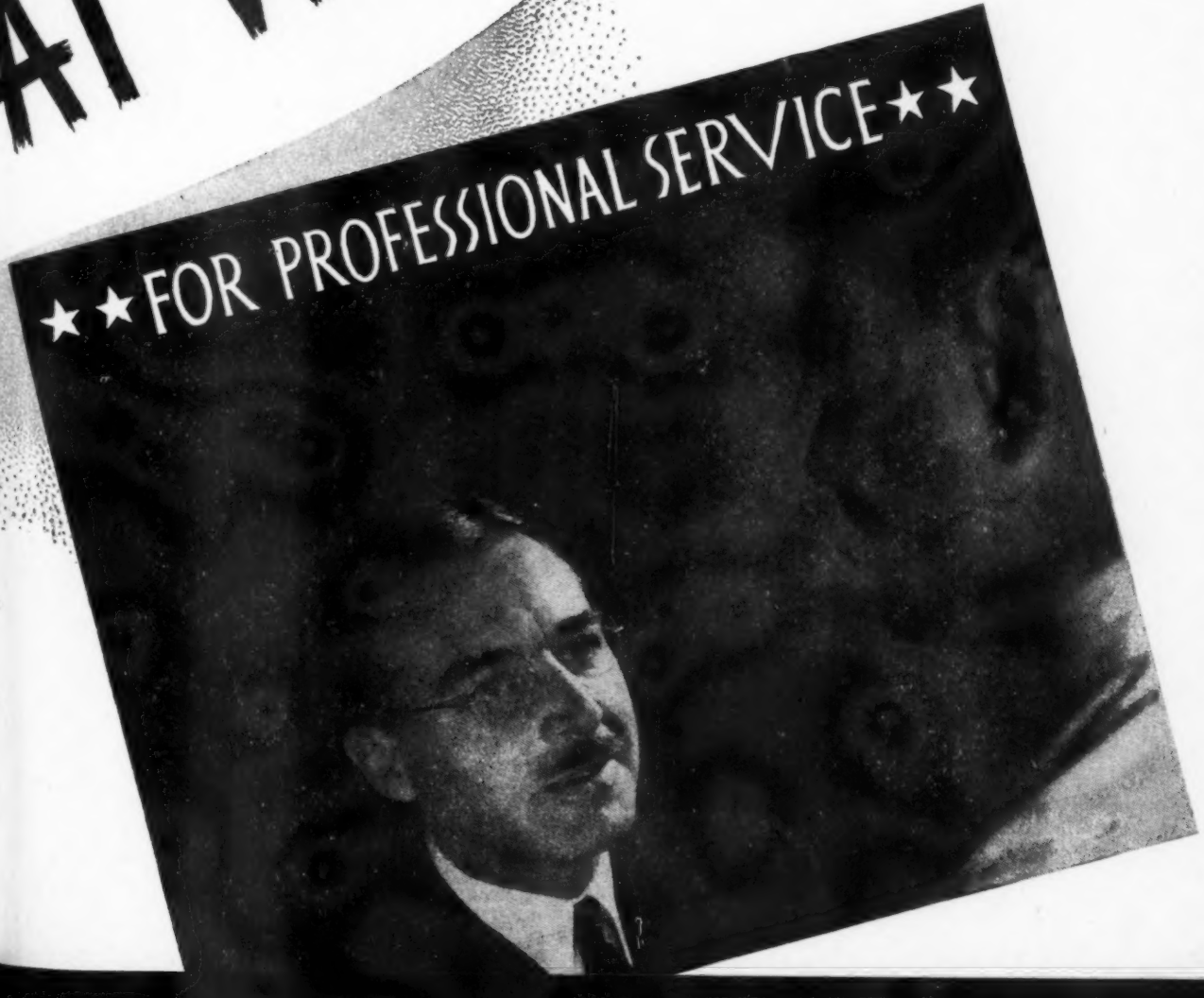

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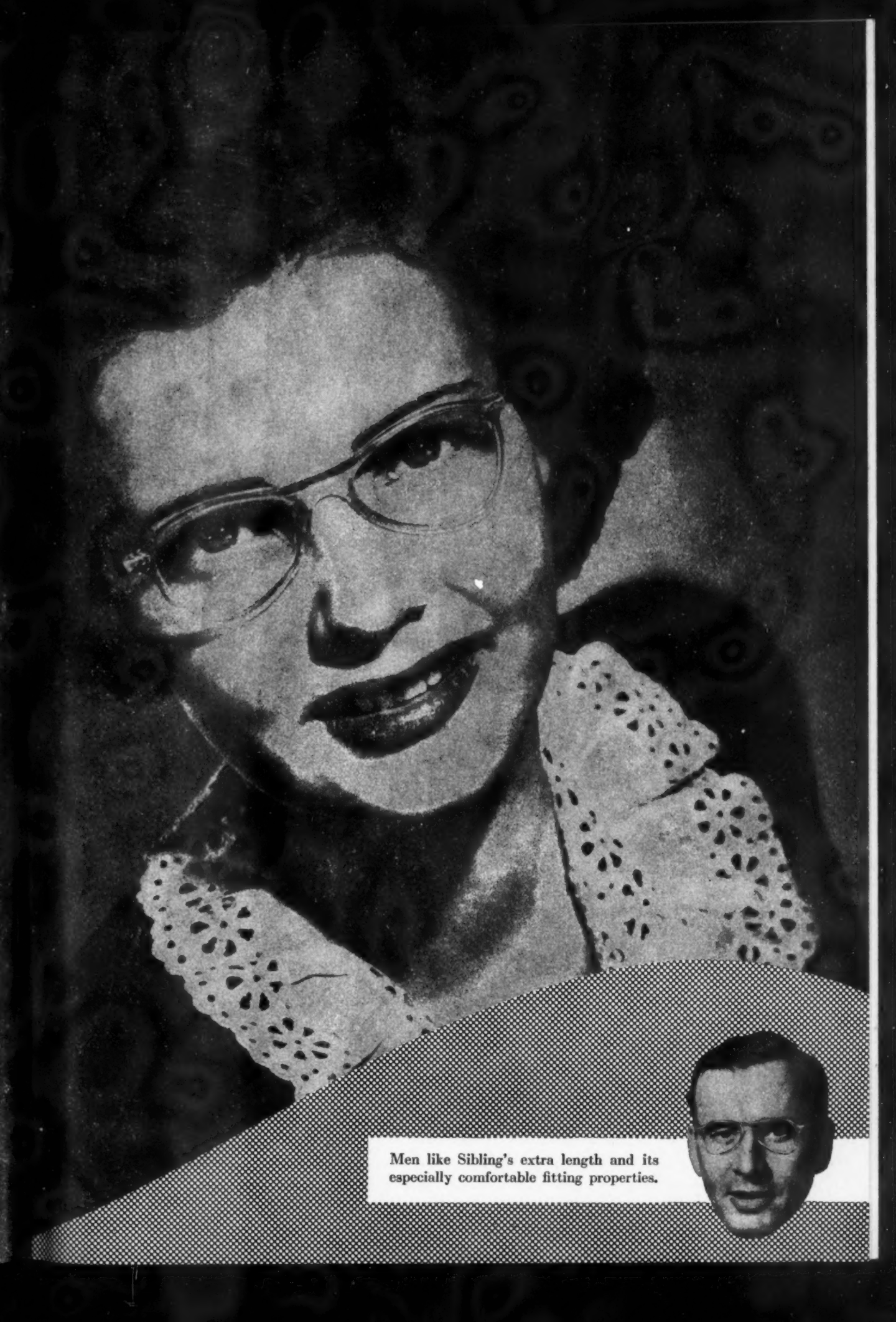
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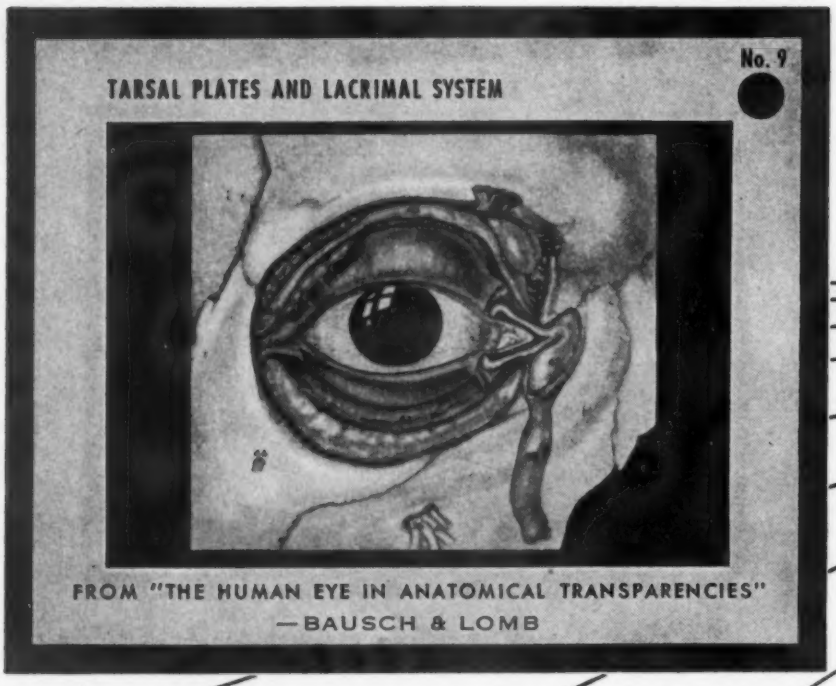

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THE NERVOUS CONTROL OF ACCOMMODATION*

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The human eye is so constructed that if we wish to view objects at various distances the dioptric power of the eye must be changed. This change in focus is readily brought about by most young people although various subjective symptoms such as head aches are frequently associated with the use of accommodation. The exact nervous control of accommodation is still subject to dispute as is the mechanics of the act. While it would seem almost essential to understand both of these factors thoroughly before attempting to deal with anomalies of accommodation, optometry has been able, largely by emperical methods, to aid subjects suffering from various disturbances in the focusing mechanism of the eye. It is still true, however, that facts are more valuable than argument in overcoming any problem.

For the last several years experiments have been conducted in the Physiology Division and in the School of Optometry of the University of California to find more facts about the nervous control of accommodation, the mechanism of accommodation, and the relationship of accommodation and convergence.† While a previous report of part of the work has already been made,[1] it seems a repetition of some of the details is worth while, particularly in view of the fact that this report will be concerned with methods and results, as well as with the interpretation of these results.

We observed that if rabbits were refracted by skiascopy before and immediately after excitation that the degree of hypermetropia was greater while the rabbit was in the excited state than in the unexcited state.[2] This

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condition could have been brought about by two methods; either there was a decrease in the innervation to the ciliary muscle over the parasympathetic nervous system or there was an increase in the innervation over the sympathetic, providing this nervous system had any control over the ciliary muscle. This latter supposition was doubtful as nearly all physiologists were agreed that the parasympathetic system was the only one influencing the ciliary muscle. However, in excitement there is a very much heightened outflow of impulses over the sympathetic without a demonstrable decrease over the parasympathetic. For this reason it was decided to do further experiments to see if this belief of physiologists was correct or not.

In neurological physiology there are two general lines of approach to any particular problem of function. One is the method of stimulation and the other the method of exterpation. In the first instance the nerve or nerves under consideration are stimulated, generally by means of a faradic current, and the effects of this stimulation are noted. This may be termed the positive method. In the second instance, the nerve or nerves are removed and again the effects are noted. This may be termed the negative method. When a muscle or organ is being considered which has two or more nerves or nerve systems innervating it, a combination of the two methods must be used.

The sympathetic supply to the head region arises in the lateral horns of the grey matter of the spinal cord. These fibers leave the cord via the anterior roots of the spinal nerves and form a chain or trunk on either side of the cord. These fibers pass up the trunk through various ganglia and then along the internal carotid artery to the cavernous sinus where a plexus is formed. From this plexus fibers pass into the orbit and enter the eye chiefly by means of the long ciliary nerves. The parasympathetic system to the interior of the eye arises at the nucleus of the Oculomotor nerve in the floor of the Aqueduct of Sylvius near the third ventricle. They then pass forward along the ventral surface of the brain to enter the orbit, entering the eye as the short ciliary nerves from the ciliary ganglion.

We first exposed and stimulated the cervical sympathetic nerve below the superior cervical ganglion. This gave rise at once to an increase in the hypermetropia of rabbits, cats, dogs and monkeys.[3] Unfortunately, such a finding does not completely answer the problem since there are still at least four possibilities: (1) The lens may be flattened by the action of the ciliary muscle in response to sympathetic impulses; (2) The

action may be due to a decrease in tonus over the parasympathetic brought about reflexly; (3) The dilatation of the pupil caused by sympathetic action uncovered areas of the lens and cornea having a flatter curve thus reducing the average refractive power of the optical system as a whole; and (4) the pull of the extrinsic muscles as well as that of the retractor bulbi caused a distorting pressure to be applied to the globe of the eye reducing the curvature of the cornea and hence increasing the manifest hypermetropia.

A series of experiments were then designed to see which of these or which combination best explained the observed phenomena.[3, 4] As mentioned above, the manifest hypermetropia increased when the cervical sympathetic was stimulated. Increases in the hypermetropia of the same magnitude were obtained when the cervical sympathetic was stimulated in animals having the oculomotor nerve cut intracranially. The same increase was observed when the cervical sympathetic was cut centrally to the point of stimulation. On the other hand, no decrease in the refractive power was observable in animals with the III nerve intact and the sympathetic caudad to the point of stimulation. These results led us to rule out the parasympathetic system as the agent causing the increase in hypermetropia. The third explanation was easily discounted since the decrease in refractive power was of the same magnitude when an artificial pupil was used. The fourth possibility was also proven false when exactly similar changes were observed in eyes having all tissue around them removed except for the nerves and blood vessels.

A peculiar and slightly paradoxial effect was obtained when the negative approach to the problem was used. It would be expected that if the sympathetic nerve supply were cut and complete recovery from the operation allowed to set in, that this eye would become slightly myopic. On the other hand, if the oculomotor nerve were cut it would be expected that the eye would become slightly hypermetropic. In the instance with the sympathetic cut there was little or no change in the refractive error on either side. On the other hand when the III nerve was cut the refractive error remained constant on the operated side, but there was a change toward increased hypermetropia on the non-operated side. These findings indicate the relative importance, to some extent, of the two nervous systems in the act of accommodation. A disarrangement in the sympathetic can be adequately compensated for by the parasympathetic, but the reverse is not true. We can say that the normal tonic contraction of the

ciliary muscle influenced by the sympathetic has little or no effect upon the refractive state.

After establishing the fact that negative accommodation can result from the stimulation of the cervical sympathetic, it seemed desirable to work out the exact pathway of these sympathetic fibers which cause a flattening of the lens.[5] The spinal cord in cats, dogs, and monkeys was opened from the 7th cervical to the 4th thoracic nerves. The dorsal and ventral roots of each nerve was exposed and the dorsal roots cut between the cord and the ganglion in order to avoid reflex effects. The cord itself was transected at the level of the 6th cervical nerve thus completely blocking all impulses from the brain and eliminating all possible reflexes except improbable axon reflexes. Each of the ventral roots were then stimulated and the resulting effects on the refractive state were observed by skiascopy. In the cat, a very occasional decrease in the refractive powers was found when the 8th cervical was stimulated; when the 1st and 2nd thoracic were stimulated the response was practically invariable, and when any other nerves were stimulated no response was elicited. In the dog, only the 1st and 2nd thoracic nerves had an effect. In the monkey, the response was more wide spread, there being an almost invariable response for cervical 8, an invariable response for thoracic 1, and an almost invariable response for thoracics 2 and 3.

Each of the three sympathetic cervical ganglia were nicotinized in order, but the response was only blocked when the superior cervical ganglion was nicotinized. This indicates that a synapse occurs for these fibers at this ganglion so that from this point forward we have the post ganglionic fibers.

In the cat, the long and the short ciliary nerves were then dissected free as possible. In this animal there are two long ciliary nerves which pass forward on either side of the optic nerve. Just before they enter the globe each nerve divides so that there are a total of four long ciliary nerves entering the eye. These may be thought of as entering at the four corners of a square with the optic nerve in the middle of the square. Between these four nerves and the optic many short ciliary nerves enter the globe.

When the long ciliary nerves were cut, the stimulation of the cervical sympathetic had no effect either on the lens or the pupil. On the other hand, cutting the short ciliary nerves or entire removal of the ciliary ganglion had no effect—stimulation of the cervical sympathetic was as effective as before.

Thus the sympathetic fibers to the ciliary muscle have the following course. They arise in the lateral horns of the spinal cord and pass into the sympathetic trunk via the ventral horns of the first and second thoracic spinal nerves. These preganglionic fibers then go along the trunk to the superior cervical ganglion where a synapse occurs. The post ganglionic fibers then course along the internal carotid artery to the cavernous sinus to enter into the formation of the cavernous plexus. From the cavernous plexus the fibers enter the orbit near the optic nerve and follow along it as the two long ciliary nerves. Before entering the globe of the eye each one divides into two nerves, so that actually four long ciliary nerves pass into the eye. These nerves go forward between the sclera and choroid to innervate the corresponding quadrant of the ciliary muscle.

Contrary to most structures innervated by the autonomic systems there is a fairly sharp demarcation in the area of the smooth muscle effected by each nerve. This is shown both by the fact that the pupil dilates unevenly when the four nerves are stimulated separately and by the fact that astigmatism is induced with its axis leaning away from the particular nerve stimulated.

Strangely enough stimulation of the sympathetic almost invariably was followed by the appearance of astigmatism of the direct or "with the rule" type. In general this astigmatism averaged 1.00 D. and appeared in 85% of the animals used. This agrees with the results obtained with the differential dilatation of the pupil mentioned above. This is in contrast to the inverse or "against the rule" type of astigmatism found when the oculomotor nerve is stimulated. This appearance of astigmatism was mentioned by Grossman[6] as long ago as 1904. In amount this astigmatism induced by III nerve stimulation approximated that shown when the sympathetic was stimulated.

We also worked out the pathway of the III nerve into the interior of the eye. Here we are in complete agreement with all modern textbooks. The fibers arise in the third nerve nucleus and pass into the orbit to synapse in the ciliary ganglion. The post-ganglionic fibers pass into the eye via the short ciliaries to enter the ciliary region where they terminate.

We have thus convinced ourselves, at least, that accommodation is the result of reciprocal action and that negative accommodation is as much an entity as positive accommodation. However, the two nervous controls are not equal partners in the act. When the sympathetic is stimulated maximally by faradic current with the III nerve completely severed, the change in refractive power generally falls within the limits of 1.00 D. to

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1.50 D. although in some 10% of the cats used this amount was considerably greater. On the other hand, when the oculomotor nerve is stimulated under similar conditions the change is in the neighborhood of 10.00 D. Normally, maximal stimulations of this nature never occur in the living intact animal. This means that the magnitude of possible changes induced by either set of nerves must be reduced.

In any reciprocal action inhibition as well as excitation are active processes so that as the number of fibers carrying impulses and the rate of these impulses increases there is at the same time a corresponding decrease in the opposing nerve fibers. If the tonal state of one set of fibers increases from some cause, this may be counteracted or balanced by a corresponding increase in the opposing system. The same may be true of decreases in tonal states. This means that within the limits of action sympathetic impulses can counteract those of the parasympathetic, but only within the limits of action. Thus, it is conceivable, for example, that myopia of 0.50 D. due to increased outflow of parasympathetic impulses could be balanced by the sympathetic, but myopia of 2.00 D. could not be so balanced.

The exterpation or the negative approach also gave important clues as to the relative importance of these two symptoms in the control of accommodation. As reported above, removal of the sympathetic was followed very shortly by complete adaptation of the animal so that it was impossible to tell that there was anything wrong with the mechanics of accommodation. This same is true in humans as reported by Cogan,[7] except that there might be a slight increase in the amplitude of accommodation. The reverse is not found to be true. In animals, removal of the parasympathetic greatly reduced the amplitude of the possible changes in accommodation and there was not the complete adaptation to the situation.

The actual mechanics of these changes induced by the stimulation of the sympathetic and parasympathetic nerves are difficult to deduce. Most histologists, according to Walls,[8] claim that the cat does not have a muscle of Müller; that is, circular fibers in the ciliary muscle. In contrast to this Henderson[9] claimed that these fibers had fair development in the Felidae. The observations seem to warrant the assumption that such fibers are most probably present. Our photographs[4] indicate that when the sympathetic nerve is stimulated there is a flattening of the anterior lens surface in the cat. The roentgenograms of Koke[10] indicate that during positive accommodation as induced pharmocologically there is a movement of the vitre-

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ous toward the central area of the eye as well as a change in the lens curvature. It is difficult to see how such changes could be induced without fibers having a circular direction or action, especially so when considering the form of the ciliary body as reported by Walls[8] after Kahmann.

The most probable theory is that of Henderson's[9] which is that the circular fibers of the ciliary are controlled by the oculomotor nerve while the radial and longitudinal fibers are controlled by the sympathetic nerves. This allows for a gradual and even change in the shape of the lens with the radial and longitudinal fibers acting much like shock absorbers rather than prime movers.

At the present time we are investigating what occurs in the eye using roentgenograms after the manner of Koke.

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A STANDARD NEEDED FOR U. S. ARMY OCULAR REFRACTIONS*

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I have been receiving the AMERICAN JOURNAL AND ARCHIVES regularly and am enjoying the material presented a great deal. The editorial in the last issue[1] was very interesting. I have often wondered how other men in the profession felt toward the recognition given optometrists in the service, especially in the army. Many times I have had the desire to write my commentary on the situation. Optometrists in the service are no doubt more concerned over the matter than those in private practice; however, it seems quite evident that the necessary attention is not being given the subject when one considers the over all importance of "professional-recognition" to those in the service, those doing public health work, and to those optometrists serving the public.

The impressions and outlook expressed by your correspondents in the editorial mentioned are comparable to those of practically all, if not all of the optometrists in the service. There is good reason for these feelings and a tendency toward loss of hope and faith. Many of the optometrists in the service have had three to five years in colleges offering courses comparable with medical and dental standards. These men have had clinical experience as well as personal private practice but it seems this fact is not realized by the officials or the public.

Slowly but surely the optometrist is being placed in the eye, ear, nose and throat clinics. Here, some are allowed to refract, others do subjective examinations and others do just dispensing and prescription writing. Some optometrists have been sent to small army posts where they are the only refractionist present and where they do all the refractive work. In many of the clinics the officer in charge has done little or no refracting prior to entering the army yet these men are given the responsibility for the quality of the work.

I have talked to several physicians in charge of such clinics and they admit they have not had the required experience or training to enable

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[1]Carel C. Koch. A Question of Rank for Optometrists in the U. S. Army. Amer. Jour. Optom. & Arch. Amer. Acad. Optom. Vol. 20, No. 12, pp. 443-445, 1943.

them to refract and they freely ask our assistance in matters having to do with refraction. In the majority of these cases I believe these physicians would prefer to have the optometrists do all the refractions but they have been given the responsibility and they have to make the best of it.

Frequently their clinical request for optometric assistance is denied. Optometric recognition must come through legislation. I believe the majority of medical men doing this work in the army see that the position of the optometrist is not right, and for their part are in favor of proper recognition, but it must be remembered that these men are not in a position to correct the matter.

Then too, the type of ocular examinations given at different clinics differs greatly, and when you see some of the work it makes you really begin to wonder. It seems there is no standard of eye examining. I would like to suggest that optometric societies, our colleges and the O.E.P., appoint a special committee to present a standard to be followed in army eye tests. Perhaps also suggesting an examination form, based on optometric teachings and national requirements which could be used as a minimum refractive procedure in the army. My experience as an optometrist in the army indicates that these standards are needed. The army has standard forms for most other types of examinations and surely an eye examination is as important as most.

Due to the pressure of work, many examinations are inadequate. In a period of war I suppose this cannot be helped, but I believe the techniques can be improved and the rules changed without materially lowering the quantity of work done, and the quality should improve. Rechecks of certain cases should obviously be made. Proper records should be kept of the refractive findings, not only of the final prescription for replacement purposes. The directive that no corrections be prescribed of less than one diopter should be modified. Phoria and duction tests should be made. The near-point should be taken into consideration.

As I have said, refractive systems in different clinics vary a great deal. Some systems, which I have seen, which were set up by interested optometrists and ophthalmologists were organized very completely while in other cases, suggestions to improve the work go ignored and you do just as you are instructed and try not to think out loud. As an optometrist you have no authority. As a rule you do not even have the respect of the men whom you refract. To them you are just a G.I. technician, and they came to the clinic looking for the services of commissioned officers.

Many optometric articles today deal with the professional advancement program. It seems to the writer that one of the most natural means to reach this goal is being overlooked,—through many army refractions made by recognized competent optometrists doing the work they have been trained to do, and surely the optometrist now in the service is capable of such recognition. The military personnel will make up a large portion of the "voice-of-the-people" of tomorrow and the optometrists in their practices now, must remember that many of these men will be your patients too.

Some mention is also given socialized medicine which the bill now before Congress is seeking to establish. Under this bill, as I understand it, control would be given to the U. S. Public Health Service and the technical services rendered for patients would perhaps follow a system similar to that recognized by the various branches of the armed services. If this proposed plan should go through the administration and recognition followed will likely be based on that used by our armed services as theirs is the only program which comes anywhere near rendering services to such a great number of people.

Recognition by the armed services will carry a great deal of weight toward the goal of the professional advancement program, directly and indirectly optometry will present its technical services to a good part of ten million men. I do not believe this fact and the possibilities it presents, are realized by members of the optometric profession.

If a committee were to draw up a plan of legislation, organization, a plan of representation, personnel required and a standard examination routine and record form, based upon present known refractive science a start could be made. It is, in my opinion, very evident that optometrists are not aware of the real, all-around importance of this matter. The time for such action is immediately. The longer this matter goes unattended the more difficult attainment becomes. The one obvious point is that recognition for optometrists is not getting the attention so plainly warranted—and without action by all optometrists there is no sign that we will receive the recognition we so justly deserve.

EVOLUTION OF COLOR VISION TESTS*

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PART I.

Though Sweden, Germany, England, France, Japan, and Russia each have their own distinctive color vision tests (Sweden the Holmgren wools; Germany the Stilling pseudo-isochromatic charts, the Nagel anomaloscope and color circle cards; England the Edridge-Green lantern and test cards; France the Schaaff mosaic diagrams; Japan and Ishihara; and Russia the Rabkin polychromatic charts), and though evidence from many sources favors distinct racial or regional differences in color vision in man (1),[1] the United States of America is still dependent upon borrowed and makeshift adaptations. It is even uncertain whether a single test adequate to gauge the color capabilities of mixed American stock throughout the length and breadth of the country could be devised. This does not mean that research workers here and there have not been alive to the need. In 1930-40 a pseudo-isochromatic test of an improved type, utilizing a design introduced by Jensen in 1936, sidestepping many of the objectionable features of the foreign charts and permitting ranking on three levels of ability, was projected by the writer. Permanent inks in suitable spectrophotometric ranges were, however, not immediately obtainable. Various other American projects are reported on this program.

A. Origin of Current Tests

Historically, the color vision tests now current have evolved under the triple stress of (1) the discovery of unique cases; (2) the launching of new theories and hypothetical categories of defect; and (3) pressure of emergencies such as great railway disasters, war, the invasion of industry by color, the need for prognosis in cases of local or general disease, or of guides in the study of heredity. The invention of new apparatus or materials, the Maxwell rotating disk and the spectrometer, gelatine and glass filters, daylight roundels, and the Munsell graded papers, has further accelerated research and test development.

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[1]Superior figures in text refer to literature cited.

*This paper is part of a symposium on Color Blindness and Color Blindness Tests arranged for the March 4-6, 1943 meeting of the Optical Society of America by the Inter-Society Color Council. From the Journal of the Optical Society of America. Vol. 33, No. 6, pp. 316-323, 1943. Part Two of the Murray report will appear in the April issue.

The first cases of deficient color vision to engage the serious attention of science (those of Harris the shoemaker and his two brothers) were reported in 1776 to Joseph Priestley, author of a treatise on vision and color (1772) (2). Others followed quickly, Scott the draper and John Dalton, the well-known chemist, reporting their own imperfections of vision in 1778 and 1794 (2). Even in these early crudely tested cases, the stock traits of aberrant color vision came out clearly: blue and yellow as the sole hues retained; the light sense and general acuity of vision divorced from chromatic sensitivity and relatively unaffected; night vision usually good. Degrees of chromatic insensitivity were also noted, incidence among women being low, with deficiency usually mild. Even heightened color contrast appears in the observations, and the occasional shortening of the long-wave end of the spectrum; likewise the congenital and hereditary nature of the defect. The solar spectrum and a length of striped ribbon constituted the first test material. Sorting out of colors from a variegated mass of samples and matching were other favorite early methods.

At first no one except Dalton realized that the defects reported were anything but individual idiosyncrasies. The fact went unsuspected that actually they affected 5 to 10 per cent of the male population, representing a reduction system, a reversion toward a similar type of eye with greatly reduced discriminations of hues, such as science has now discovered on the lower levels of evolution (3).

In the mid-nineteenth century, however, theory gave a new slant to testing, and large blocks of the population were presently examined. Helmholtz revived Thomas Young's physiological mixture hypothesis of color vision of a half century earlier. Nature, Young had suggested in 1801, was hardly likely to have wasted seven specific sense receptors on the spectrum colors when three pigments, red, yellow, and blue, and their mixtures, suffice for the entire gamut of the artist's palette. Guided like Newton by analogies between light and sound stimuli, by the fact of forced vibrations (to account for intermediates), and a fancied parallel between the spectrum and the musical scale, Young at first linked his trineural, mechanism with the artist's triad, red, yellow, and blue, the vibration frequencies of which are as 8, 7, and 6. Next year, influenced by Wollaston's diffraction spectrum with its prominent red, green, blue, and violet bands and reduction of yellow to a narrow line, Young shifted to another trio, red, green, and violet [see his *Lectures on Natural Philosophy* of 1807 (4)]. The corollary followed that color vision

defects must result from lack of one of a trio of nerve fibers or photo-chemical processes. Red-, green-, and later violet-blindness, linked with insensitivity to the ends or middle of the spectrum, were therefore poisted (though violet-blindness had been observed only experimentally with the aid of drugs), and tests began to be blocked out accordingly.

In 1875, following a shocking railway disaster, in Sweden, that country took the lead, Faithiof Holmgren of Upsala developing a wool-matching test, more systematic than the old sorting ones, but handicapped by rigid adherence to a *priori* categories of defect, and an unwise choice of test and match skeins, as time has shown (5), (27), (28). Adopting unreservedly Helmholtz' tentative triune visual processes, and his early hypothetical red-, green-, and violet-blindness, abandoned or radically altered by the theorist himself in the second edition of his Optik (1890), Holmgren picked as standards to be matched for detection of the three types of colôr blindness three large skeins of a very pale yellowish green, a purplish pink or "rose" (toward violet) representing a mixture of the end colors of the spectrum, red and violet; and a vivid signal red. Careful directions for the use of each are given, together with the reasons for non-equation of the chromas, but subsequent users usually ignore the instructions, and assume the three large skeins were designed each to test one of the three defects, shifting them about the spectrum accordingly.

Furthrmore, confusing shortening of the spectrum with "red-blindness," Holmgren or his followers, reasoning by analogy, came to assume that in "green-blindness" green is not merely dulled but darkened. This error is perpetuated in colored plates of confusion hues, as well as in the keys to green matches, to the perplexity of examiners even today.

All this in spite of the testimony of many able color-blinds, Dalton and Dr. Pole among them (6) that they were neither red-blind nor green-blind, but red-green blind, seeing in the spectrum only blue and yellow in various shades, with at most a gray band in the green region (in the neighborhood of 500 mμ).

The Holmgren test was early adopted by railroads throughout Northern Europe and America. Belief in three mythical types of deficient vision, no authentic case of which has ever been rcorded to the writer's knowledge, was thus widely disseminated, persisting even today. It is noteworthy, however, that some of the Mediterranean races refused to accept the Holmgren test, based on the Scandinavian eye.

A German scientist, Ewald Hering, presently launched a different

type of theory, based directly upon observed facts. Hering added green to Young's original trial of red, yellow, and blue (thereby arriving at Leonardo da Vinci's favorite basic four). These four primaries Hering linked in pairs, red-green, and blue-yellow, on the basis of half a dozen sets of observed phenomena—after-imagine, color contrast, color mixture, peripheral field limits, invariability, etc. (7). Speedily out of this, the tetrachromatic or "opposites" theory, grew a more promising type of test, of the pseudo-isochromatic or "vanishing pattern" order.

In the meantime, however, some new and puzzling deviations from normal color vision had come to the fore, and given another slant to the test situation. As early as 1835 Seebeck at Berlin, interested in the industrial handicap, had discovered among his color-blinds a number atypical and unclassifiable in their responses, distinguished when tested with the spectrum by a loss both of color and light sensitivity in the long wave end, in varying degrees (8). Rayleigh presently undertook the investigation of a handful of similar odd cases among so-called normals, who required varying amounts of red in an R+G=Y mixture (now known as the Rayleigh equation; carried out sometimes with lights, sometimes with reflecting surfaces and rotating disks). Two out of 23 he classed as red weak, five as green weak, the remainder, himself among them, as normal. Von Kries followed with just four cases—two normals, two aberrant—and on this sketchy basis launched two new categories with misleading Greek names, protanopia (literally blindness to the first primary) and deuteranopia (blindness to the second) (9). Nagel added protanomalous and deuteranomalous to characterize Rayleigh's two divergent groups.

Actually, the new fact discovered suggests a trend toward atavism, a reversion toward the more primitive night eye of our ancestors and of many animals. For along with relative insensitivity to long-wave stimuli (showing in both chromatic and light response) there is the Purkinje shift of the brightest strip of region back along the spectrum toward violet that is characteristic of night vision, perhaps a slight shift of the entire set of hue responses. Seebeck's and Rayleigh's discovery of scoterythrous vision shortening of the spectrum in the red, which may overlay normal vision or R-G deficiency, was probably what influenced Holmgren (who apparently confused it with hypothetical red-blindness) in his test set-up. By false analogy, in so-called "green-blindness" he and his followers assume a complete fadeout or a blackout of the middle of the spectrum.

In the new Stilling pseudo-isochromatic charts, based on the Hering

theory of four primaries, appearing shortly after the Franco-Prussian war, there is special provision for scoterythrous vision (Plate VII), also for the doubtful, semi-pathological blue-yellow blindness or weakness that had also come to the notice of science (Plate VIII). Hering, as above stated, assumes (instead of three) *four* primary chromatic responses, linked in pairs, blue with its antagonistic hue yellow, red with its opposite green. These hues (a slightly bluish red and bluish green) are antagonistic or opposite in the sense that when mixed, in their ordinary daylight intensities or reflectances, they will not combine to form an intermediate hue, as yellow, but neutralize each other. Further, each of a pair tends to induce a halo of its opposite on the adjacent area, or on the same area after its removal or extinction. Either chemical, electrical, physical, or neural factors would afford a basis for these phenomena. The fact that the basis is at present undetermined is unimportant. The usefulness of tetrachromatic theory in diagramming color experience as such in normal and aberrant cases is unparalleled, and gradually achieving recognition.

Guided by these new principles, Stilling of Strasbourg, about 1877, with the aid of a red-green blind artist and a blue-yellow blind teacher, worked out his vanishing pattern charts experimentally by disk mixture and matching. In his charts digits made up of colored dots or blotches of varying brightness and size appear on a field of dots in a confusion or interchangeable color (also in varying size and brightness). Reddish orange on dull yellows, and yellowish green on orange browns were first used to demonstrate red-green blindness; dull dark reds on dull dark yellows, red-green weakness. Reddish orange on yellowish red (on a pale yellowish red ground) tested blue-yellow blindness; medium red on light and dark browns (or low chroma yellows), scoterythrous vision. In the latter plate, as in some of those in later editions, Stilling's usual finesse in diversifying chromas and brightnesses in the digit hues as well as in the field is missing, hence the digit is too readily legible even with shortening of the spectrum.

The test has run through many editions (10). Lately Dr. Hertel of Berlin has taken it over, adding new charts, altering the old. Either he has not checked his plates as carefully as Stilling, or he has fallen back on the old Helmholtzian categories, or else he has adapted the test to the North German eye (whereas Stilling worked in the Franco-German city of Strasbourg in southern Germany). Incidentally, Hertel has utilized some of the clever variants of design exploited by Ishihara in which a

figure (instead of disappearing) is transformed into another in the vision of the color deficient.

Other tests representing outgrowths of the Hering theory, products of the psychological laboratory, set such tasks as *serial arrangement* and *hue classification*. In the last fifteen years Myers and Pierce (11) in England, Murray, Terman, and Farnsworth here (12) have used these methods; Spry of the Munsell Color Company also in his Student Charts. The subject is required to work his material into something resembling the continua that make up the color solid (whether double cone or pyramid). Derived also from the "opposites theory" are the tests that make use of the law of color induction (color contrast and complementary colored after-images), Cohn's letters in gray on a colored ground (1878-1905), Wiltberger's horizontal color strips and choice of vertical matches (1941).

Ophthalmology, under pressure to measure progressive acquired disability, has devised perimetric and hue threshold tests (13). The application of the Gaussian curve of error to the frequency distribution of biological traits by Galton and Pearson and World War I led R. A. Houstoun of Glasgow to undertake long-needed tests on unselected groups of the population. Trying out Rayleigh's suggestion that deviation in the Rayleigh equation (the amount of lithium red that must be added to thallium green to match sodium yellow) might be a matter of normal variation, Houstoun devised new tests of red sensitivity, and on groups of 5-600 reported that von Kries' and Nagel's set-up of opposed and clear-cut classes (protanopic and deuteranopic, protanomalous and deuteranomalous) in color-blinds and normals (the former based originally on four cases) was the result of discarding intermediates. Darkening of the long-wave end of the spectrum is in part normal variation (protanomaly), in part perhaps a general lowering of neural sensitivity (protanopia), a step toward twilight vision or toward total color blindness, with innumerable degrees of graduations of sensitivity in either form. Houstoun as a result of his investigations abandoned Helmholtzian premises, and substituted direct measurement of long-wave sensitivity for the equivocal and time-consuming Rayleigh equation (14).

The development of color printing led C. S. Myers and W. Pierce of the National Institute of Industrial Psychology in England in the 1920's to devise an industrial test utilizing serial arrangement or matching of red, yellow, and blue chroma series of lacquered disks, the revision and scoring of which was prolonged over several years under a Rocke-

feller grant (11). The Lovibond color glasses in 20 chromas, the Glenn Colorule (blues which range in one series to yellow, in another to green, with great change with altered illumination), and the I.S.C.C. Color Aptitude Test represent other outgrowths of industrial needs (15).

B. Classification of Tests

During the last 75 years, under pressure of rapid transit and modernized warfare problems, hundreds of tests have been evolved, though the perfect all-purpose test is as yet undiscovered. Those current today may be classed (1) according to stimulus media employed (reflected or transmitted light); (2) as photopic or scotopic, according as daylight or dark adaptated eye is used; (3) as individual or group; (4) by scoring method, qualitative or quantitative; (5) by response, according as simple or complex mental operations are required, or motor or verbal responses stressed (16).

(1) Tests may be classed according to the stimulus media employed (transmitted or reflected light). Besides spectroscopic light and filters of known transmission, standardized papers are available, formerly the Hering, Heidelberg, and Engelking for perimetry, today the Munsell, Ostwald, and others (17).

(2) They may be scotopic or photopic, utilizing the daylight or the dark-adapted eye. Too often there is no exact specification in the records. More daylight tests are needed, using precise control of transmitted as well as reflected light.

(3) Tests may be individual or group. Examples of the latter are the Podesta wall charts of 1916, Westcott's lantern slides of the Holmgren wools, Berens and Stein slides of some of the pseudo-isochromatic plates (18). Apart from the difficulties of Kodachrome reproduction, standardizing of the color temperature, or spectral energy distribution of the source, and the doubtful ethics of unlegalizd use, all group tests involve distortions of perception. They may serve to single out a few cases for further examination but the scores of those in front and rear rows will not be comparable. Variation in visual angle means also encountering such differentiated retinal areas as fovea, macula, red-green-blind zone, blue-yellow blind, optic disk, and possible scotomata. Deception is also less easy to control.

A gelatine filter lantern projection test of the vanishing pattern order using Landolt's broken circle in solid color on a solid ground has been prepared by MacAdam. The opening of the circle may be rotated to any position, and the hue to brightness of ring or ground varied to a match.

The number of discriminable hues in the color continuum may thus be determined, as well as "confusion colors." Color mixture equations, e.g., the amount of blue to be added to red to match gray, for the ordinary red-green blind, and the range of deviation should also be obtainable by this method, within the limits of available color filters. But for color blindness tests the design lacks the flexibility of the mosaic type of pseudo-isochromatic pattern which allows in a single plate for individual differences in luminosity function by latitude of brightness of the dots.

For rough screening work in small classrooms, an improved replica of the Holmgren sorting test with 6–8 standards instead of 3 [P, B, BG, G, Y (dull), R and R tint, Gray], and 36 variants in chroma and brightness of the standards (along with intermediates) has been used by Murray to isolate R-G blind and R-G weak. The 5″ standards (roughly equated in brightness and chroma to minimize use of secondary criteria) and the 4″ matches are displayed in wall charts on a neutral wall. A cross-section self-recording blank is provided, and the score is quantitative, the best subjects rating three times as high as the lowest. With this test two color-blind, two color-weak and one borderline have been isolated in a high school art class of 50, results checking with Ishihara, Nagel, and others. This resembles Snyder's and Terman's hue classification tests and may be given or repeated individually with a smaller set.

(4) Tests vary also according as the scoring is qualitative, with subdivision into totally color-blind, R-G blind, B-Y blind, scoterythrous (protanopic), etc.; or quantitative, with numerical score indicative of discriminative ability or sensitivity in certain ranges. General practice in scoring the qualitative or differential tests is not uniform, some examiners taking (mistakenly) an all-or-none stand for a pass (as in the Ishihara), others allowing 25 per cent error. None of the pseudo-isochromatic tests were planned for quantitative scoring at the outset, certain digits were designed to be *visible*, other to be *invisible* to a certain type of disability; other patterns were planned for other defects or degrees of deviation. The plates with digits are not equated in difficulty, and for five years or more war conditions the color printing of the Japanese and German plates (always a difficult matter) has been less uniform in successive editions. The verdict "pass" or "failure" has validity only when rendered by an expert examiner.

Quantitative ranking is possible in a wide variety of tests, though it tends to obscure types except in specially designed differential tests, such as those for chroma threshold, or luminosity. Such scoring alone,

however, makes possible the distribution curves for large segments of the population, normal, and deviate, needed to establish the fact that the old stereotyped groupings, such as protanope and "proteranomalous," are too rigid, the matches and confusion colors deduced from them for test construction too narrow.

Much of the scatter on the quantitative scoring of any given test, as Houstoun has pointed out, is probably due to secondary causes inherent in the method, e.g., slight deviations in reflectance, hue-adaptation, timing, failure to grasp instructions, lapse of attention, etc. It is doubtful whether any ranking finer than quartile or quintile position in the group is valid, or any correlation except by the rank method feasible. An excellent example of quantitative scoring and a reasoned method of obtaining total scores from certain pseudo-isochromatic tests for use in figuring correlations is given in Philip's series of studies (19). His card sorting test by *color mass* (the numerical predominance of chroma-equated R, P. B, or G spots on a white card), with three trials, for groups of four to six hundred yields a range of scores fitting a normal curve and allowing decile rating. While planned primarily for use in psychometrics, the test could readily be adapted to the detection of the color-weak in certain ranges, especially if time scores are included in the rating. The Nela wool matching test also yields numerical scores, but failure to rule out secondary aids (chroma and brightness clues) invalidates them. Edridge-Green with his card test (vanishing pattern) and color perception apparatus attempts to grade the individual directly as monochromic, dichromic, etc., to heptachromic (20).

Examples of self-recording tests are Jennings' adaptation of the wool test, Murray's hue classification, and the I.S.C.C.'s projected single judgment test, using R and pR chips in pairs of fixed chroma difference, with electric button recording. Self-recording blanks and devices all encounter the hurdle of low intelligence, and difficulty in following instructions. Jennings' record sheet was often inserted wrongly, Murray's required understanding of "under" and "opposite," prepositions in the use of which children of foreign-speaking parents invariably experience difficulty.

(5) Tests may be grouped further according to the type of response exacted of the subject, with emphasis predominantly on verbal or motor aspects; or on mental processes of varying complexity. The first group range from Hess' pupilloscope registering the effect of chromatic stimulation on the iris muscle, through Edridge-Green's lantern, calling for

correct naming of colored lights under many permutations, his bead-sorting (requiring manipulation of materials), to Roaf's reproduction of design in paints or crayons, or the adjustment of rotating disks or spectrometer screws to a match. Clumsiness or embarrassment and other factors must be reckoned with, often offsetting the aid to attention of a definite manual or verbal reaction.

The mental processes involved may take the form of (a) a simple judgment such as the presence or absence of a given hue in chromatic threshold, color contrast and after-image tests, or in the Nagel cards; or the recognition of a hue in bead-sorting. (b) Judgment based on a perceptual field, as in the Philip dominant color test, or in the "vanishing pattern" charts. The latter, maintained at a fixed distance, does double duty, testing color discrimination and substituting roughly for perimetry; for constriction of the color fields in the color weak, or central scotoma from tobacco neuritis, will hamper legibility of a digit or design, especially if speed is kept constant. (c) A third type of response is of a higher order, conceptual or analytic, though often confused with simple judgment. It presupposes ability to analyze color experience, and abstract brightness from hue or chroma, chroma from brightness or hue, or hue from either, an ability that even trained scientists may lack. E.g., the physicist, preoccupied with transmitted light, often fails to recognize chroma as distinct from brightness. Inability to make these abstractions renders many instructions "Disregard brightness and match by hue solely" (as in the Nela) futile. The experimenter must equate chroma and brightness (as nearly as possible for atypical subjects) in order to clear the stage for hue judgments.

Ability to make these abstractions of a higher order is assumed in tests based on the psychological solid such as serial arrangement of chroma, hues, and brightnesses, or hue classification. (Pierce's industrial chroma series test, Murray's twenty-hue circle, Farnsworth's hundred-hue.) Untrained normal subjects make on matching tests many of the mistakes of color deviates, from sheer inability to analyze out hue from their integral color perceptions, classifying pinks with yellows, while refusing to sort fawns and browns with the latter, luminance rather than hue dominating their unanlytical color perception.

The above five test groupings are all more or less superficial, based on methodological factors—physical, physiological, psychological. A more significant classification is (6) by purpose. The aim, broadly speaking, of all color vision tests is either theoretical and exploratory, or prac-

tical and prognostic. The former group for the most part rely on the use of spectrally homogeneous light, the precision of apparatus controls and laboratory backgrounds. The latter are frankly utilitarian, designed (a) to screen out the dangerously aberrant in transportation systems where recognition of signal lights or judgments on terrain are vital, or (b) prognostic, with a view to diagnosing defect, and recession or progress in clinical cases—testing, e.g., chromatic deterioration in disease or toxic conditions, and the success of remedial measures (use of drugs, vitamines, practice with colored filters).

The two groups, theoretical and practical are, however, not mutually exclusive. The first or research group acts as feeder for new short-cut practical tests; while each of the latter becomes valid only by checking against results obtained by more accurate and thorough research methods, applied to sizable control groups of normals as well as deviates.

C. Theoretical and Exploratory Tests. Retrospect and Prospect.

The older tests were based on the physicist's spectrum, and such research problems as the determination of the limits of the spectrum, the position of neutral bands, location of the brightest hue in the solar spectrum, the number of discriminable hues and the mixtures by which each region may be matched.

Latterly efforts have been directed rather to determining what has happened to the psychological color solid in the various types of defect: e.g., the number of hues of equated chroma retained on the perimeter of the color square; the chroma thresholds for the four stable hues; the number of discriminable chroma steps in R, G, B, and Y as compared with those for the normal eye; the relative brightness of these hues in the deviate's solar spectrum.

Other research problems include perimetric determination with standard colors or lights (21) of the limits of each color field in aberrant vision, and the location of possible scotomata. Measures of hue, chroma, and speed in color contrast and after-images, of recognition memory for hues, determination of paired confusion colors for different types of deficiency, have also received attention and demand more, by the methods now in use for normals (22).

The exploratory research which provides the soil out of which short-cut practical tests must be evolved is, however, as yet utterly inadequate, as both the Scotch physicist Houstoun and the British industrial expert Wright have recently pointed out (23). A vast amount of work on sizable groups, not single individuals, laboratory "standard observ-

ers" or "typical" protanopes or deuteranopes, remains to be done before even the colors necessary for an all-purpose screening test can be selected.

This was brought home to the writer by the discovery in 1928 of an atypical deviate retaining only the hue yellow, along with a normal black-white-gray continuum, and no pathological symptoms. Though reported as a case of achromatopsia, examination disclosed a spectrum with an extended chromatic area in the region of the sodium lines, thinning out into the green and red regions of the normal. Search of the literature for an analogous case (to the extent of several hundred references in the intervening fifteen years) has afforded convincing proof of the inadequacy of recorded research on either normal or aberrant color vision as a basis for classifictory tests. This holds for procedures, apparatus, recording, and number of cases on which conclusions are based.

Experimenters fail to record or standardize the state of adaptation of the eye, scotopic or photopic, to take account of the brightness contrast induced by the black surround of an instrumental eyepiece, or of retinal rivalry from the unused eye (an intermittent clouding of the field). In the few experiments conducted with the surround illumined, specification of the amount (footcandles) or spectral composition of the illumination is usually omitted. Ordinary yellowish mazda is reckoned as "white light," or "sensation white" of unknown spectral composition is substituted for the solar beam, rendering many comparisons invalid. Shortening of the spectrum at either end is highly significant in color cases, yet the wave-length record is meaningless unless the stimulus magnitude is also recorded. An artificial pupil standardizes data, but records in terms of an equivocal "photon" may be misleading.

Omission of specific record of stimulus magnitudes renders reference to spectral region by wave-length virtually useless to the careful experimenter. Owing to the Bezold-Brücke law (shift of hue with constant wave-length but variable intensity, little understood but probably related to the different physiological levels of the red-green and blue-yellow limens), all color stimuli but the four stable primaries G, Y, R, and B, appear as slightly different hues at different intensity levels; e.g., 525 mμ (slightly yellowish green at moderate intensities) in the lower intensity ranges simulates 500 mμ (pure green) for the average eye. Similarly, 620 mμ (reddish orange) at lower intensities simulates pure red; at higher a yellowish orange.

The complex geography and topography of the retina (fovea, macula lutea, color zones, optic disk) are customarily ignored, and visual

angle or distance unrecorded (the latter important because the near-sighted eye favors red, the far-sighted blue). Chroma and brightness, or chroma and hue, are not differentiated (accounting for some of the discrepancies in hue discrimination data). The swift onset of fatigue (local adaptation and contrary hue induction) especially with transmitted light stimuli, hence the need of timing and spacing observations, is usually overlooked.

Instructions and test materials fail to take account of the deviate's reliance on brightness and saturation clues rather than hue, e.g., his tendency to substitute "darker" or "more vivid" for "redder," in directions, hence the need of equating brightness and chroma in paired hue comparisons.

Convinced of the great variability of color deviates, the difficulty of fitting them into the "classical typologies," and the need of modernizing and standardizing equipment so that observations may be repeated in widely separated laboratories, with no great financial outlay, the writer secured in 1932 a gray room equipped with Corning daylight lamps, spectrometer, adaptometer, perimeter, neutral and color filters and a set of Munsell papers as a basic outfit (24). No photo-cell photometer measuring light accurately to hundredths and thousands of a footcandle is, however, commercially available. Colored filters transmitting only the critical band, 500–510 m*u*, and low chroma papers, especially in the yellows and the blue-greens are also unobtainable for research.

On the experimental and research side there are needed: (1) calibration of the spectrum in terms of the four stable and invariable primaries (two in the case of the deviate) a task left unfinished by the late Gosta Grönberg (25); (2) a table equating the 40 Munsell hues by direct observation with color patches in a standardized Nela ribbon filament spectrum (restored to the relative intensities of the solar beam); and (3) distribution curves for the normal eye for hue thresholds and limits of the color field, secured with standardized stimuli.

Part Two of the Murray Report will appear in the April issue.

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INIMICAL DISCRIMINATION AGAINST THE MALE NURSE AND THE OPTOMETRIST

Men nurses, like men from other walks of life, are serving with the Army, the Navy, the Marine Corps, and the Coast Guard. They are subject to the draft. Unlike women nurses who serve in the Army and the Navy, however, men nurses are not given the rank of officers upon going into either service.

Even before this country entered the present war this problem was of great concern to the Men Nurses Section of the American Nurses' Association. Early in 1941, at the request of the Section, the ANA took the

matter up with the Office of the Surgeon General of the Army, whose representative stated that: "It would be impracticable to employ male nurses in time of peace since such employment could complicate unnecessarily the administrative problems. We feel that we have provided a satisfactory and dignified position for such male nurses as may be employed during the military emergency."

It was pointed out by the Surgeon General's office in subsequent correspondence that "The promotion of enlisted men of the regular Army and trainees inducted under the Selective Service Act is a function of the commanding officer of the hospital of the station at which the soldier is serving. It is the policy of this office to utilize male nurses in their professional capacity whenever their services are required. Instructions have been issued by this office to all responsible medical officers serving throughout the country that the agreement with the Red Cross be adhered to. In brief, this agreement stipulated that after the initial four months of service as a trainee any male nurse who holds a registration card issued by the Red Cross will be promoted to the rank of technical sergeant, provided a vacancy in that grade is available."

At the moment the preceding paragraph from the Surgeon General of the Army has a very familiar ring to those of us in optometry. But let us further review the "fix" in which the male nurse finds himself, during this world war for freedom.

This country was at war when the Biennial met in 1942 in Chicago. The following resolution was adopted by the ANA House of Delegates during that session: "That the American Nurses' Association in convention assembled in Chicago, May 17-22, 1942, address a communication to the Surgeons General of the Army and of the Navy, respectfully requesting that graduate, registered, professional men nurses, members of the American Nurses' Association, be given the opportunity to serve as nurses as soon as possible after induction or enlistment into the armed forces of the country."

Following this action, information was received from the Acting Executive Officer of the War Department, Charles L. Kirkpatrick, to the effect that: "At the present time, upon induction, individuals are classified at the reception centers. Registered male nurses should be sent for duty to the Medical Department of the Army. Tables of organization do not allow for male nurses as such; however, they are employed under the title

of medical technician, and as such are utilized in a nursing capacity commensurate with the past training received."

And from the Surgeon General of the Navy, Ross T. McIntire, came information to the effect that: "Men nurses, if otherwise qualified, may enlist directly in the Hospital Corps of the U. S. Naval Reserve with rating up to Pharmacist's Mate, second class. The base pay of this rating is $96.00 per month, and men with dependents may receive, in addition, a quarters allowance of $37.50 per month. A complete outfit of clothing is provided all men on first enlistment. Men nurses who are accepted, with rating in the Hospital Corps based upon their civilian professional training, should receive rapid promotions in view of their special knowledge and the continuing expansion of the Navy."

At a meeting of the ANA Board in January, 1943, the Men Nurses Section offered the following recommendation: "That the Board . . . decide on appropriate legislation to be introduced to secure professional recognition and rank for licensed men nurses in the Army, when sufficient data to support such legislation have been compiled and when a better understanding of the need for such legislation has been developed."

This recommendation was accepted by the Board with the understanding that it be referred to the ANA Committee on Federal Legislation, this committee to work with the Men Nurses Section on this question.

Meanwhile, the Section has sought to secure as much information as possible about the men nurses in service by means of a questionnaire study. Such information will be extremely useful when and if legislation is introduced. The data which follow are a partial report of that study.

The study shows that a large proportion of the men nurses reporting are assigned to services where their nursing experience can be used. However, the men nurses in this study who have undergone officer training and received commissions have rather consistently gone into the Medical Administrative Service. As LeRoy N. Craig,[1] Chairman of the Men Nurses Section, has stated: "In general, in the services the best use has not been made of registered men nurses because they are not given professional recognition and rank as officers which would enable them to assume duties and responsibilities consonant with their professional training. In the psychiatric service, for instance, there is and will be urgent

[1] Men Nurses and the Armed Services. American Journal of Nursing, Vol. 43, No. 12, pages 1066-1069. 1943.

need for men nurses to teach and direct the enlisted men assigned to that service. The same thing is true of other specialized services. Without an officer's status the man nurse cannot function effectively. The men nurses in the service recognize this. Some of them have applied for and gone through officer training which has taken them into other fields in the service. The result has been that the nursing and medical service has lost these men nurses who could have made a valuable contribution in teaching, supervision, and leadership of the corpsmen."

Here is a problem somewhat similar to that presented by ophthalmology and optometry in the Army. In nursing, women who enter the armed services do so only as officers, receiving commissions as soon as they are sworn in. Men nurses, however, who receive the same three year training as do the women, are refused commissions in the armed services on the rather flimsy ground that in peace time their use might create certain administrative problems.

Men nurses, after much patient waiting, are now prepared to go to Congress with their logical request for fair treatment.

In the refractive field a parallel situation exists. Army ophthalmologists receive commissions. Army optometrists do not. Both do the same piece of refractive work, although from what data we can gather the optometrist is now called upon to do the greater part.

If women nurses with three years of only hospital training are eligible for Army and Navy commissions, certainly optometrists with four years of college training should be equally eligible.

CAREL C. KOCH

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

by J. Fred Andreae, Secretary

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

BILL INTRODUCED TO COMMISSION OPTOMETRISTS IN THE ARMED SERVICES

According to the OPTICAL JOURNAL AND REVIEW a bill authorizing the President to appoint optometrists as commissioned officers in the Medical Corps of the Army and the Medical Corps of the Navy, was

introduced in the House of Representatives on Jan. 25 by James Hardin Peterson (Dem.) representing the First Congressional District of Florida. Known as H. R. 4063, the bill was referred to the Committee on Military Affairs.[1]

The Peterson bill reads as follows: *"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

"That the President is authorized to appoint as commissioned officers in the Medical Corps of the Army and the Medical Corps of the Navy, upon the recommendation of the Surgeon General of the Army or Navy, as the case may be, optometrists who are regularly licensed to practice as such in any State or in the District of Columbia.

"Sec. 2. The Surgeon Generals of the Army and Navy are authorized to jointly and severally prescribe regulations to govern the recommendation of such optometrists for commissions."

From the initial report dealing with this matter it appears that this bill was introduced in the lower house, not as the result of organized action on the part of optometry, but rather because of the clear-cut justice of optometry's position when the true facts were called to the attention of Congressman Peterson.

Obviously, this is the time that calls for united action on the part of all optometrists and on the part of all optometric organizations as well. The bill is introduced. It is no longer a theory but a fact. A companion bill can easily be introduced in the upper chamber. Then, irrespective of previous thinking or position relative to this important subject of commissions for optometrists in the service, all optometry should swing in line to make this, or some better bill, a law.

The case for optometry is so clear and the stand taken by the profession is so sound and just that there is simply no excuse for further delay.

Congressman Peterson's action calls for immediate commendation. His clear thinking on this subject has already advanced the position of optometry and he now looks to the profession to bring the bill to a favorable vote. This is a project that calls for the united action of all optometrists. Local, state and national organizations should and must take on the assignment of bringing the bill out of committee for prompt and proper action, or writing a new bill that we can support.

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[1]Bill to Commission Optometrists. Optical Journal and Review of Optometry. Vol. LXXXI., No. 4, p. 33, 1944.

Here is a worthy job for the American Optometric Association. It is a big task, well within the scope of the organization and not in the least beyond its abilities. It is a job that can and must be done. Our men in the service deserve our fullest support and in this activity our practitioners on the home front will stand squarely behind the capable leadership of the A. O. A. H. R. 4063 or similar bill must pass.

CAREL C. KOCH

ANNOUNCEMENTS

U. S. VETERANS ADMINISTRATION TO UTILIZE OPTOMETRICAL COLLEGES

The Vocational Rehabilitation Division of the U. S. Veterans Administration has indicated that optometrical colleges will be assured of their proper place in the postwar vocational training program. Veterans of World War II who require vocational rehabilitation and who wish to enter the profession, will be given every consideration and aid. Although the war has not entered upon its final stages, almost every community in the country has had discharged veterans come home. Estimates vary, but the present rate is probably 35,000 a month. Many of these men are eligible for government paid schooling—professional and vocational education. Officers of the American Optometric Association, aware of the gaps in the ranks of optometry made by calls to the Service, by retirement and by death, have been desirous of bringing the profession to the attention of qualified veterans. The official organization in charge of directing veterans into vocational and professional schools is the Veterans Administration. The Office of Public Relations, Dr. H. Ward Ewalt, Jr., director, has conducted a campaign to inform the Vocational Rehabilitation Officers of the Veterans Administration of the opportunities for achievement and service which exist in the field of optometry. Since the Veterans Administration is decentralized, with each state conducting its own affairs on a more or less independent basis, it has been necessary to write the 53 Regional Officers of Vocational Rehabilitation. Each of these officers has had several letters, together with descriptive and informative literature.

MIDDLE ATLANTIC EDUCATIONAL CONGRESS

The Middle Atlantic Educational Congress announces a four-day meeting, April 9, 10, 11 and 12, at the Hotel Roosevelt in Pittsburgh. The main topic of the Congress this year is "The Reduction and Control of Myopia." The Middle Atlantic Educational Congress will devote its entire program to this important and timely subject. Several of the outstanding optometrists in the country will speak and help solve the orthoptic training problems involved in arresting and correcting myopia.

Dr. H. S. Kane, Jr., is Chairman of the General Committee in charge of the meeting. Three hundred optometrists are expected to attend. Registration is scheduled for Sunday, April 9th at 12:00 noon, to be followed at 3:00 P. M. by speakers. Classes will begin Monday morning at 9:00 A. M., continuing through Wednesday afternoon. A fellowship dinner will be held on Tuesday evening at 6:30 P. M., after which an informal evening of discussion is planned.

NATIONAL SURVEY PROGRESSES

The national survey of optometrists now being conducted by the A. O. A. is in full swing. It is hoped to have this "optometric census" completed by the time of the meeting of the House of Delegates in July. The survey follows as a sequel to the 1943 drive for membership. In this, as in the survey, the A. O. A. drew heavily on the manpower of the optical industry to cover the field. For instance, in the membership drive, the American Optical Company made over 7,500 contacts, actually signing up some 6,000 individual optometrists. The optical industry as a whole is to be commended for its unselfish response to this "induction into service." The A. O. A. is fortunate that its request for this help, both in the membership drive of 1943, and the survey of 1944, met with ready response by the members of the optical industry.

SPECIAL REPORTS

ACTION STARTED TO COMMISSION OPTOMETRISTS

A. Virginia Flatten
Minneapolis, Minn.

If there still exists a doubt in the mind of any optometrist as to the need for legislation to commission those optometrists now in the armed

services, let him cull through the daily accumulation of mail received at the editorial office of any of the leading optometric publications.

Optometrists, attached as they are to the eye, ear, nose and throat departments of hospital units in both the army and the navy, somehow find time to write, and their many good letters all follow much the same pattern. They are doing the work of professional men. They are fulfilling their duties and performing their tasks as cheerfully as possible. They realize that war is unpleasant and difficult and they expect hardship. But they also expect justice and expect too, their professional associates to give them whatever help is logically due them.

These optometrists will no doubt expect prompt and immediate action on H. R. 4063, the Peterson bill to Commission Optometrists, when they learn of this bill. The following excerpts are taken at random from our files and are presented to again emphasize the need for immediate and forceful action on our part. It should be remembered that it is at the level of the local and state associations that the real job must be done under the general direction of the officers of the A. O. A.

An optometrist (Ph. M. 3/c) attached to the U. S. Naval Hospital at Oakland, California, writes: "Keep after commissions. I enjoy reading your publication very much and I find it fine publicity to pass along my copy to the medical men in the EENT department."

An optometrist (corporal) with the medical section, Camp Adair, Oregon, writes: "There are two of us here and we do all the refracting. Our captain is a competent ophthalmologist who respects and commends our work. We believe it would be a good idea to make a survey of optometrists in the Army who are practicing optometry. A factual record of the number of optometrists doing visual work would be good evidence of our contribution to the war effort."

An optometrist (Staff sergeant) with the medical section, Station Hospital, Santa Ana, California, writes, "I am writing to let you know how much I appreciate your articles in the journal concerning our status in the army. You may be quite sure that we in the army shall not forget the seeming indifference of our national association towards our problem. It may be that they are doing the best they can, but if so, they should let us know what is going on. The way I feel at present, I am not at all sure that I shall be a member of the national association when I return to private practice."

An optometrist (private) with the Station Hospital, Camp Cowder, Missouri, writes, "It has been with great satisfaction that I have read your

numerous editorials in reference to commissions for U. S. Army Optometrists. Keep up the splendid work. However, I feel we have all expressed our desires for recognition long enough—it is now time for action."

An optometrist (Ph. M. 3/c) attached to the U. S. Naval Hospital at Farragut, Idaho, writes, "I think your campaign for commissions for optometrists in the army is a good idea. Remember too, that many optometrists in the navy require similar help."

And from the home front the demand for action is equally great. Typical of many letters received is the following from Dr. G. William Seabold of Baltimore, Maryland, who says, "I have been reading with a great deal of interest your articles in the 'Journal' concerning the question of commissions for optometrists, and I want to take this opportunity to say that many of us here in Maryland, still in civilian practice, approve of your attitude and are grateful that finally someone has started agitation in the right direction.

"It seems disgraceful to me that after fooling around for over two years now that the best we have to offer our men is a probable sergeant's rating, and worse still, that even this is not assured. We hear a lot these days of public relations and student procurement programs. How can we induce young men to take optometric courses, or further our public relations, if we are compelled to admit that after completion of training, the best we can do for that man is to offer him a place as private in Uncle Sam's army? With the present day emphasis on eventual military service, how can we expect to attract intelligent young men to optometry if that is all we can offer? Or how can we expect a successful public relations program if the public ever realizes, as a whole, in what a shameful position we in optometry now find ourselves? It is my own personal belief that the procurement of commissions for our men would be the biggest and most important step forward, with its attendant effect on student procurement and public relations, of anything that could happen in optometry.

"Again let me say that we appreciate your efforts, and commend you for your persistence in calling it to the attention of the powers-that-be in optometry that we do not approve of present methods and demand more aggressive action and real results, not more promises and talk of conferences and committee meetings."

Thanks to Congressman Peterson "the-ball-has-at-last-been-put-into-play." Our period of waiting is over. Adequate legislation when passed will grant what every optometrist knows is right and proper. Both in

and out of optometry the feeling is spreading that optometrists should serve their country as commissioned officers. Whether they do or not is up to the optometrists now serving on the home front.

SOCIAL AND PSYCHOLOGICAL FACTORS IN THE ANTI-SEMITIC ATTITUDE*

J. F. Brown

Psychology Department, Kansas University

Psychologists have dealt experimentally and theoretically with the problem of the origin and development of social attitudes. It is no longer considered that these are determined solely by either the hereditary nature of the individual or his environment, but rather by the structure of the sociopsychological field. By this is meant the distribution throughout both the environment and the individual of biological, psychological and sociological forces. Our premise is that to understand the nature and origin of the anti-semetic attitude we must consider both the psychobiological nature of man and the socio-economic nature of modern culture.

Racial antagonisms give rise to what the psychologist calls stereotypes. The stereotype is formed by abstracting certain characteristics from a class, and building these into symbols for the class. This can be an economical and socially valuable process only if *all* the pertinent characteristics are used in the symbol, and not if—as in the case here—only *some* are selected on a basis of emotional or evaluative predispositions. Anti-Semitism gives rise to a stereotype of the Jew which exaggerates or distorts physiognomic characteristics and culturally conditioned responses of some Jews, overgeneralizes these to pertain to all Jews, and completely omits other characteristics.

In our culture anti-Semitism is always latent. Interracial hostility is an exacerbation of a social reaction tendency which is constantly present. This tendency comes from what social psychologists call the in-group and out-group antagonism; that is, the tendency for members of any social group to emphasize feelings of affection for their own group and of hostility for other groups. When competition turns to conflict, the increase in in-group solidarity bears a direct relationship to out-group hostility. For centuries the Jew has represented a minority group that has never been

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*This article was condensed from the author's chapter, "The Origin of the Anti-Semitic Attitude," I. Graeber and S. H. Britt, editors. *Jews in a Gentile World* (New York: The Macmillan Company, 1942). An abridgment of the material from The Journal of Educational Sociology, Vol. 16, No. 6, pp. 351-354. 1943.

assimilated into the leading national "racial" stocks. This means there has always been latent anti-Semitism, because there is always latent hostility between in-groups and out-groups even when in certain respects the in-group includes the out-group, as the total-national group in a democracy includes the Jewish-national group.

In order to compete with the Gentile, some Jews develop special economic and cultural abilities. To drive the bargain some Jews become sharp; this sharpness becomes distorted into the predatory economic aggressivity of the stereotype. To compete with the Gentile capitalist, some Jews band with other Jews; this racial cooperation becomes distorted into the Jewish "binnen-moral." When financial manipulation was considered below Gentile dignity, some Jews developed proficiency in finance; this has led to the distortion that all Jews are moneybags. Thus anti-Semitism forces some Jews into business practices that become distorted into stereotypes which increase anti-Semitism. Similar things happen to members of other groups.

Further, the practices of the orthodox Jewish faith—the costumes of the rabbi, the feast dates, the dietary prohibitions, and the use of Yiddish—single the Jew out, and emphasize his different culture.

Gentile children are taught to love Christ, who was himself a Jew, and to hate the other Jews who murdered him. But the Christian faith is the authority behind many of the frustrations of childhood. Unconscious resentment of childhood frustration which we can never openly express against Christ may become expressed against Jews through his identification with them.

Man begins as an animal chiefly motivated by biological mechanisms that must be controlled by society if society is to be maintained. The frustrated urges do not disappear but are rather repressed; they are forced into the unconscious and "forgotten." Much of our everyday behavior originates from repressed and unconscious motives. Anti-Semitism is a socially acceptable way of expending repressed and pent-up energy. This process makes use of three psychological mechanisms: (1) *displacement*, the discharge of emotional energy on objects other than the original target; (2) *projection*, the attribution to others of attitudes and behaviors that cannot be accepted in the self; (3) *rationalization*, the substitution of consciously acceptable motives for true motives which are not consciously acceptable. Viewed psychologically, anti-Semitism represents a displacement of aggression with a projection of guilt and a rationalization of motives.

The average Jew possesses a "racial" individuality, largely physiognomic, that sets him apart from the non-Jewish individual. The physiognomic difference leads to psychological differentiation. The Jew early becomes conscious of his Jewish characteristics, and in a culture which is dominantly Gentile is inclined to develop inferiority feelings. These tend to be *overcompensated* by aggressive behavior, which in its turn becomes the source of further anti-Semitism.

Finally, the Jew is the biological and cultural equal to the Gentile. Psychologically we love, hate, and fear our equals more than our inferiors. It is also known that outlet for emotional urges is most easily obtained with face-to-face love and hate objects. The Jew, who is so widely distributed over the earth, is everywhere available as a target for aggression.

Thus, for a variety of reasons, the Jew is the recipient of displaced hostility. In modern psychopathology it is realized that any symptom is *overdetermined;* that is, it results not from a single cause but from the combination of a number of factors. Anti-Semitism is a sort of sociopathology, and is overdetermined by deep psychobiological and socioeconomic casual factors. Its control will be furthered only if we face it with a full realization of its nature.

BOOK NOTICES AND REVIEWS

Books received are acknowledged by notices in this department. Special selections will be made for more extensive review in the interest of our readers as space permits.

PSYCHOTHERAPY IN MEDICAL PRACTICE. M. Levine, M.D. Assistant Professor of Psychiatry, University of Cincinnati Medical School. Puplished by the Macmillan Company, New York City. 320 pages. Cloth. $3.50. 1942.

This book is a treatise on psychotherapy and is a text which also might be termed a "handbook of minor psychiatry" for the non-psychiatrist. It should prove an indispensable guide for general practitioners and specialists who find a constant need for psychiatric understanding. It is recommended for optometrists and others who must understand and guide patients through visual and emotional problems. The author outlines clearly, in rather non-technical language, the methods of treatment that lie within the province of the non-psychiatric health worker.

T. O. B.

AN ATLAS OF HUMAN ANATOMY FOR STUDENTS AND PHYSICIANS. C. Toldt, M.D. Assisted by A. D. Rosa and M. E. Paul. Published by the Macmillan Company. 957 pages. 1505 illustrations. In two volumes. Cloth. The set $12. 1941.

This text has been reissued with improved printing, paper and binding, from American-owned plates. It is said that this atlas contains more illustrations than any of its kind published in English. The 1505 figures and line drawings are from actual specimens, reproduced in from one to five colors. This work is a recognized atlas of human anatomy. There are two volumes, divided into six sections, each with full appendices and index.

T. O. B.

VERTEBRATE PHOTORECEPTORS. S. W. Detwiler, Ph.D. Professor of Anatomy, Columbia University. Published by the Macmillan Company, New York City. 184 pages. Cloth. $4. 1943.

This monograph presents a general account of the visual cells of vertebrates with particular emphasis upon their structure, development, distribution, and certain aspects of their physiology. It is a valuable handbook for all concerned with problems of retinal physiology or for anyone with a general interest in the biology of the retina. Full attention is given to the role of vitamin A in vision. Retinal photopigments, night blindness, and restorative therapy, and the possibilities for structural regeneration of damaged rod visual cells due to prolonged vitamin A deficiency are all thoroughly treated in the light of recent investigations.

T. O. B.

DISEASES OF THE EYE. Sir John H. Parsons, M.D., F.R.C.S. Assisted by H. B. Stallard, M.D., F.R.C.S. Published by the Macmillan Company, New York City. 726 pages, illustrated. Cloth. $7. 1942.

This is the 10th edition of this standard text on ocular pathology. Some new material has been added in those sections dealing with anaesthesia and operative procedure.

T. O. B.

PUBLIC HEALTH ADMINISTRATION IN THE UNITED STATES. W. G. Smille, Ph.D. Professor of Public Health, Cornell. Published by the Macmillan Company, New York City. 553 pages. Illustrated. Cloth. $4.25. 1940.

This is the second edition of this text. The author is a distinguished research worker in the field of epidemics and is also an experienced administrative officer in the field of local public health work. This edition brings up to date recommended principles and practices in public health administration. It is only of interest to optometrists insofar as it gives a better understanding of the problems encountered in doing mass health work and those which may confront our profession under certain programs of socialized medicine should these come after the war. There is no mention of eye work as such, in the text, but the author does review the advances which have been made during the past five years in public health administration. T. O. B.

INTRODUCTION TO SOCIOLOGY. J. L. Gillin, Professor of Sociology, University of Wisconsin, and J. P. Gillin, Associate Professor of Anthropology, Duke University. Published by the Macmillan Company, New York City. 806 pages. Cloth. $3.75. 1942.

This book endeavors to lay the foundations for a scientific understanding of human life in society. Human social life is compared with that of other animals; the mechanism of learning and the structural and functional characteristics of culture are investigated. Group life in general is analyzed, followed by a survey of the various types of groups, classified by the factors which bring them into existence and maintain them. A consideration of the general features of social institutions is followed by an analysis of the most important of these. The dynamic aspects and the maladjustments of society are also treated. T. O. B.

I WANTED TO SEE. B. Dahl. Published by the Macmillan Company, New York City. Cloth. $2. 1944.

Blindness is one of the most serious of human misfortunes, but it need not mean tragedy. This is the lesson to be learned from this sincere and moving story of Borghild Dahl. Near-blind from babyhood, she has lived a fuller and more useful life than many less handicapped. A wise mother taught her self-reliance; her own ambition took her through college, an honor student. Then, on graduation, came the real test:

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T. O. B.

PHYSICAL CHEMISTRY. E. S. West, Ph.D. Professor of Biochemistry, University of Oregon Medical School. Published by the Macmillan Company, New York City. 368 pages. Cloth. $5.75. 1942.

The aim of this book is to present the selected phases of physical chemistry which are recognized as basic along with an understanding of biological phenomena. The text is designed for students and places special emphasis on the necessary mathematics so that the student may understand the material presented. The book includes a tabulation of chemical literature, a discussion of atomic structure, chemical combination and related data which form the basis of modern chemistry.

T. O. B.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list, although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

6. OCULAR AND GENERAL PATHOLOGY

KERATOCONJUNCTIVITIS. Special Report. Journal of the American Medical Association. 1943, 121, 14.

Industrial keratoconjunctivitis is highly infectious. Workers in industry suffering from this condition should be isolated until the condition ceases to be active. The symptoms of keratoconjunctivitis are as follows; the condition may be preceded by a low fever and a mild generalized malaise. The local ocular symptoms are merely those of a for-

eign body or conjunctival irritation. One eye is usually affected first, and in a large percentage of these cases the second eye becomes infected within five to eight days. Preauricular and submaxillary glandular involvement with tenderness is common in a high percentage of cases. Edema of the lids and the conjunctiva, especially the transitional fold, is very frequent. The conjunctiva presents the appearance of a simple purulent conjunctivitis but with little or no formation of pus. Small areas of pseudomembrane are not infrequent and, when removed, leave either small white dotted points or some bleeding points. The bulbar conjunctiva becomes edematous early. At this stage there is some lacrimation and photophobia, but real pain and blepharospasm do not appear until the cornea becomes involved. The proportion of cases in which corneal involvement occurs varies from 50 per cent to 90 per cent. In six to twelve days after the conjunctivitis appears, the cornea becomes involved by the appearance of discrete gray infiltrates that lie in and immediately under the epithelial layer of the cornea. They may be confined to the periphery of the cornea, but in a large percentage of cases involve the pupillary area of the cornea directly. These infiltrates are discrete and seldom become complicated by an erosion of the corneal epithelium, with resultant staining with fluorescein. The extent of visual impairment depends on the number of infiltrates and their location. T. O. B.

ENDOCRINE DYSFUNCTION. T. G. Atkinson. Optometric Weekly. 1943, 34, 46, 1321.

"The commoner endocrine dysfunctions which show up in analytical optometry relate to the thyroid, the parathyroids, or the suprarenals.

"The thyroid is the master activator of general body metabolism. Hence we expect a hyper-active thyroid to result in a general speed-up, and a hypo-active thyroid in a general slow-down, of body metabolism.

"Hyperthyroidism, which is not always or necessarily associated with enlargement of the thyroid, seldom manifests itself much before adolescence. Such patients are always underweight, with rapid pulse, and mental and nervous excitement. They usually have abundant, fine silky hair, and soft, moist, sensitive skin, which perspires easily. The pupils are dilated. The muscles are unduly spastic, especially the unstriped muscles, and it is this condition which constitutes the reaction in the visual mechanism, particularly in the ciliaries. In marked cases there is an 'intention tremor' in the skeletal muscles, i.e., the muscles tremble when called into action, which can be demonstrated by having the patient

extend his arms and hands in front of him; and this applies also to the extrinsic eye muscles. It is not difficult to figure out what the effect of all this neuro-muscular excitability and hypertonicity will be on the co-ordination of the visual mechanism.

"Hypothyroidism becomes evident, as a rule, during childhood. These patients are just the opposite of the hyperthyroid. They are overweight, with slow pulse, and mental and nervous sluggishness. They usually have dry, harsh skin, with scanty, coarse hair. The pupils are small. The muscles are flabby. In marked cases the mental sluggishness may amount almost to idiocy, known as cretinism, but these are rare. The effect upon the ocular mechanism is just what might be expected, namely, neuro-muscular atony and insufficiency. All performance is noticeably below par.

"The parathyroids are the most powerful antagonists of the thyroid, which normally keep the action of the thyroid within due bounds. Hence a parathyroid insufficiency (parathyroid excess is practically unknown) has much the same effect as excessive thyroid activity. But the parathyroids have also a positive function of their own, namely, the promotion of calcium fixation in the body. Therefore, parathyroid deficiency produces signs and symptoms along that line, too. These children are small and wiry, nervous and tetanic, often to the extent of having muscular spasms and tics. The pupils are dilated. The bones are small and soft, frequently rachitic, including the teeth. The muscles are exceedingly spastic, great hypertonicity.

"The effect of parathyroid deficiency on the ocular mechanism is perhaps more marked than that of any other common endocrine dysfunction. The extreme tonicity of the muscles interferes with every attempt at coordination. They just won't behave. The child is usually myopic, often progressively so, due to the lack of calcium in the structure. Here we encounter the unusual combination of weak, poorly toned muscles which are nevertheless highly reactive and jittery. Orthoptic training in such cases is next to valueless unless the endocrine dysfunction is remedied. Indeed, muscle exercises in the presence of the endocrine disorder may even be injurious.

"Bearing in mind that the special function of the suprarenals is to maintain blood pressure and to give tone and strength to the skeletal muscles, one can easily deduce the effect of suprarenal deficiency. Excessive suprarenal, again, is practically unknown as a pathologic entity. These patients have abnormally low blood pressure, with its consequent lack

of energy and very weak, flabby striped muscles. The effect upon the ocular mechanism is seen chiefly in the extrinsics. Ductions are extremely low, and the internals, in common with all the striped muscles of the body, easily become fatigued. In fact, muscle fatigue is one of the prime features of suprarenal deficiency.

"This condition of suprarenal deficiency is much more general than is commonly supposed or appreciated. It is especially related to toxicity. In some way not any too well understood, the suprarenals play an important part in the defense mechanism of the body against infection, and are called upon, sometimes almost to straining point, in severe or long continued infections. The consequence is that an individual who has undergone such an infection is often left with badly depleted suprarenals, with all of the above described mischievous effects.

"One of the most striking examples of endocrine deficiency as a cause of ocular defect, already referred to, is seen in myopia, especially progressive myopia. Just which of the endocrines is chiefly involved in any individual case is not any too clear. Parathyroid deficiency, as we have seen, is a fruitful cause, because of poor calcium fixation. But only a small proportion of progressive myopes are parathyroid deficiency patients. Undoubtedly the suprarenals play an important role; and myopes, as a rule, show most of the stigmata of deficient adrenal secretion, as described above. Where this endocrine factor is present, we usually have a progressive stretching of the choroid and sclera, and choroidal degeneration grafted onto the original biologic factor of an elongated eyeball. No doubt this is due, in the first place at any rate, to the lack of tone in the coats of the eye from lack of adrenal endocrine, and too poor fixation of calcium.

"On the whole it may be said that as long as these endocrine excesses or deficiencies persist no amount of orthoptic training will avail to correct the ocular dysfunctions which result from them. It may further be said that only in childhood, or at latest in youth, can such endocrine dysfunctions be actually remedied, and balance restored. In later years the best that can be done to keep feeding the patient the needed endocrine substance to either stimulate or antagonize the faulty gland, much as we have to keep feeding the diabetic patient insulin to insure his sugar metabolism. Such patients should therefore be taken in hand early."

A. V. F.

NEUROSYPHILIS IN RELATION TO OPHTHALMOLOGY.

I. Levy. Journal of the Medical Society of New Jersey. 1942, 39, 581.

The author points out that whenever an examiner sees an irregular or fixed pupil he should immediately have the patient checked for syphilis of the central nervous system. He comments on the Argyll-Robertson pupil and the Syndrome of Adie. With the Argyll-Robertson pupil syphilis is always present even if vision is normal and the fundus is perfect. Levy adds, however, that the most discouraging feature of syphilis of the visual pathways is that of satisfactory method of treatment has not as yet been developed. C. C. K.

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9. HYGIENE AND ILLUMINATION

THE EFFECT OF REFLECTION ON INDUSTRIAL PRODUCTION. J. H. Hammon. Indiana Optometrist. 1943, 15, 5, 8-9.

To be free from annoying reflection in industrial production two conditions must be complied with. These are "first, we must have sufficient light to form clear images of the objects of regard. If refractive condition will not permit clear images to be so formed, it must be corrected with lenses to the point where such interpretation can be had with the least expenditure of nervous energy. Second, we must eliminate light that is permitted to enter the eye obliquely that tends to change the relation of the light and dark of the image parts. This character of light produces glare."

To accomplish these ends, Hammond claims we must "first, protect, as far as possible, the machine and space where industry is accomplishing a production result by shading or reflecting light not used in the operation from such operator. Second, we have discovered that there are apparently certain laws that govern reflection as it relates to the various portions of the spectrum, and we believe that image interpretation takes place in that select portion lying on the D line of the spectrum, and we know that when we reflect light we do apparently change the frequency of its movements and also change to some extent the relative amount of D line light into light of other frequencies and characteristics. We have found by experiments that pigment can be made to cover reflecting surfaces so that there is little if any light reflected except that at or near the D line and that other light is abolished by absorption. Hence, we believe that all walls and adjacent structures should be painted with yellow pigment to accomplish the result and complying with the conditions will increase production in industries." T. O. B.

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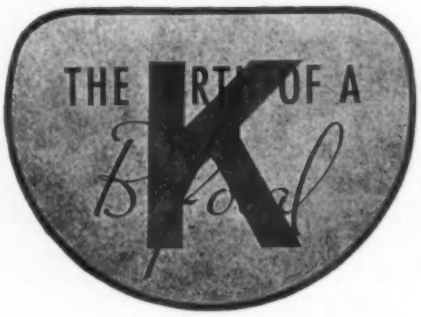

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